

In this manner, the connection of the relay chamber block BD to the rear of the action block BC is completed. Thereafter, the end face OF of the action block BC whereat discharge orifices OR are installed is polished by the use of polishing sand (#1000 or more) so as to form a smooth surface. Subsequently, cleaning is effected to remove any polishing sand and unnecessary materials which have entered into the grooves LV through the orifices OR during the polishing. Whether or not the end face OF has become a completely flat surface and whether or not the interior of the grooves LV has been completely cleaned is checked up and, when the polishing is incomplete, the end face OF is re-polished and subsequently cleaning is effected. A similar check-up is effected and, when the result of the check-up is "No", this step is repeated and, when there is no defect, the assembly of the block BC and the block BD is dried.

Further, the completed head is joined to an aluminum plate and the lead electrodes are connected to a flexible wiring plate.

A specific example of the ink jet recording effected by the use of the thus obtained recording head will now be described by reference to FIG. 12. In FIG. 12, for convenience of illustration, the various component blocks are shown as being separated from one another. Actually, however, the various components and blocks are of course made integral with one another by cementing, as described above. In this shown example, recording ink is first introduced into each long grooves LV through the components BH and BH'. Next, when an electrical pulse signal is applied to the heat generating resistor, not shown, there is generated a thermal pulse and as a result, the ink is momentarily gasified. By the bubble created by this gasification, a pressure wave (action force) is applied to the ink, as a result of which the ink discharges and flies in the form of substantially uniform droplets through the orifices OR communicated with the grooves LV and these droplets adhere to the recording member, not shown, thereby accomplishing the recording.

When an experiment of ink discharge by the six recording heads completed as described above has been actually carried out by the use of ink of the following composition under the experimental conditions as mentioned below, stable discharge of ink droplets has taken place over 109 times or more in any of these recording heads and the dots obtained have been substantially uniform. The discharge speeds of the ink droplets have been as shown in the table below.

		Water	70 parts by weight		50
		Diethyleneglycol	29 parts by weight		
		Black dye	1 part by weight		
Recording head		Applied pulse conditions			Ink droplet
No.	D(l ₄ in component PB)	Voltage	Pulse width	Frequency	discharge speed (unit: m/sec.)
1	80 μm	40 V	10 μsec.	10 KHz	1.3
2	150 μm				1.5
3	350 μm				2.0
4	800 μm				3.2
5	1500 μm				3.6
6	2500 μm				1.9

As has been described above in detail, according to the droplet forming apparatus shown in the embodiment, there can be provided an ink jet recording apparatus in which the responsiveness of ink droplet discharge to the information signal input and the discharge state of ink droplets are very

good and the output level is high so that record images of good quality can be provided at high speed.

Although not shown, the droplet forming apparatus of the present invention described above in detail may of course be modified into a multi-orifice array type to sufficiently achieve the aforementioned objects. In this case, the liquid supply to each action chamber may be effected through a common liquid supply chamber communicated with the liquid introduction port of each of a plurality of action chambers.

What we claim is:

1. A process for producing a substrate for an ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, the process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of pairs of electrodes each connected to one of the plurality of heat generating resistance members, wherein each said pair of electrodes and each corresponding heat generating resistance member integrally form a U-shaped wiring member with a bent portion arranged with all of said bent portions facing in the same direction; and

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form the substrate, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate.

2. A process for producing an ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, the process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of pairs of electrodes each connected to one of the plurality of heat generating resistance members, wherein each said pair of electrodes and each corresponding heat generating resistance member integrally form a U-shaped wiring member with a bent portion arranged with all of said bent portions facing in the same direction;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form a substrate for the ink jet recording head, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate; and

attaching a liquid passageway forming member onto the substrate, whereby a plurality of liquid passageways are formed each corresponding to one of the U-shaped wiring members.

3. The process according to claim 2, wherein the end portions of the plurality of liquid passageways are formed corresponding to the end portion of the base plate.

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4. An ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, the ink jet recording head being produced by a production process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of pairs of electrodes each connected to one of the plurality of heat generating resistance members, wherein each said pair of electrodes and each corresponding heat generating resistance member integrally form a U-shaped wiring member with a bent portion arranged with all of said bent portions facing in the same direction;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form a substrate for the ink jet recording head having a cut end portion, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate; and

attaching a liquid passageway forming member onto the substrate, whereby a plurality of liquid passageways are formed each corresponding to one of the U-shaped wiring members,

wherein the end portions of the plurality of liquid passageways are formed corresponding to the cut end portion of the substrate.

5. An ink jet recording apparatus comprising an ink jet recording head comprising a plurality of discharge openings

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for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, and means for supplying electric power to the ink jet recording head, the ink jet recording head being produced by a production process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of pairs of electrodes each connected to one of the plurality of heat generating resistance members, wherein each said pair of electrodes and each corresponding heat generating resistance member integrally form a U-shaped wiring member with a bent portion arranged with all of said bent portions facing in the same direction;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form a substrate for the ink jet recording head having a cut end portion, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate; and

attaching a liquid passageway forming member onto the substrate, whereby a plurality of liquid passageways are formed each corresponding to one of the U-shaped wiring members,

wherein the end portions of the plurality of liquid passageways are formed corresponding to the cut end portion of the substrate.

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6. A process according to Claim 1, wherein each heat generating resistance member is a planar member having a longer side extending along the liquid passageway and a shorter side orthogonal to the liquid passageway, with the longer side having a length at least two times as long as the length of the shorter side.

7. A process according to Claim 1, wherein each said pair of electrodes and each corresponding heat generating resistance member are laminated in layers.

8. A process according to Claim 2, wherein each heat generating resistance member is a planar member having a longer side extending along the liquid passageway and a shorter side orthogonal to the liquid passageway, with the longer side having a length at least two times as long as the length of said shorter side.

9. A process according to Claim 2, wherein each said pair of electrodes and each corresponding heat generating resistance member are laminated in layers.

10. An ink jet recording head according to Claim 4, wherein each heat generating resistance member is a planar member having a longer side extending along the liquid passageway and a shorter side orthogonal to the liquid passageway, with the longer side having a length at least two times as long as the length of the shorter side.

11. An ink jet recording head according to Claim 4, wherein each said pair of electrodes and each corresponding heat generating resistance member are laminated in layers.

12. An ink jet recording apparatus according to Claim 5, wherein each heat generating resistance member is a planar member having a longer side extending along the liquid passageway and a shorter side orthogonal to the liquid passageway, with the longer side having a length at least two times as long as the length of the shorter side.

13. An ink jet recording apparatus according to Claim 5, wherein each said pair of electrodes and each corresponding heat generating resistance member are laminated in layers.

14. A process for producing a substrate for an ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways, each communicating with one of the plurality of discharge openings, the process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of electrodes, including at least one selective electrode and at least one ground electrode, with each of the plurality of heat generating resistance members being connected to a selective electrode and a ground electrode, wherein each heat generating resistance member and corresponding selective and ground electrodes integrally form a U-shaped conductive path with each U-shaped conductive path facing in the same direction, and each heat generating resistance member being a planar member having a longer side extending along the liquid passageway and a shorter side orthogonal to the

liquid passageway, with the longer side having a length at least two times as long as the length of the shorter side; and

cutting the base plate along a line substantially parallel to the line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form the substrate, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate.

15. A process for producing an ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, the process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of electrodes including at least one selective electrode and at least one ground electrode, with each of the plurality of heat generating resistance members being connected to a selective electrode and a ground electrode, wherein each heat generating resistance member and corresponding selective and ground electrodes integrally form a U-shaped conductive path with each U-shaped conductive path facing in the same direction, and each heat generating resistance member being a planar member having a longer side extending along the liquid passageway and a shorter side orthogonal to the liquid passageway, with the longer side having a length at least two times as long as the length of the shorter side;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form a substrate for the ink jet recording head, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate; and attaching a liquid passageway forming member onto the substrate, whereby a plurality of liquid passageways are formed corresponding to the U-shaped conductive paths.

16. An ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, the ink jet recording head being produced by a production process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of electrodes including at least one selective electrode and at least one ground electrode, with each of the plurality of heat generating resistance members being connected to a selective electrode and a ground electrode, wherein each heat generating resistance member and corresponding selective and ground electrodes integrally form a U-shaped conductive path with each U-shaped conductive path facing in the same direction, and each heat generating resistance member being a planar member having a longer side extending along the liquid passageway and a shorter side orthogonal to the liquid passageway, with the longer side having a length at least two times as long as the length of the shorter side;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form a substrate for the ink jet recording head having a cut end portion, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate; and

attaching a liquid passageway forming member onto the substrate, whereby a plurality of liquid passageways are formed each corresponding to one of the U-shaped conductive portions,

wherein the end portions of the plurality of liquid passageways are formed corresponding to the cut end portion of the substrate.

17. An ink jet recording apparatus comprising an ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, and a controller for supplying electric power to the ink jet recording head, the ink jet recording head being produced by a production process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of electrodes including at least one selective electrode and at least one ground electrode, with each of the plurality of heat generating resistance members being connected to a selective electrode and a ground electrode, wherein each heat generating resistance member and corresponding selective and ground electrodes integrally form a U-shaped conductive path with each U-shaped conductive path

facing in the same direction, and each heat generating resistance member being a planar member having a longer side extending along the liquid passageway and a shorter side orthogonal to the liquid passageway, with the longer side having a length at least two times as long as the length of the shorter side;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form a substrate for the ink jet recording head having a cut end portion, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate; and

attaching a liquid passageway forming member onto the substrate, whereby a plurality of liquid passageways are formed corresponding to the U-shaped conductive paths, wherein the end portions of the plurality of liquid passageways are formed corresponding to the cut end portion of the substrate.

18. A process for producing a substrate for an ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways, each communicating with one of the plurality of discharge openings, the process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of electrodes, including at least one selective electrode and at least one ground electrode, with each of the plurality of heat generating resistance members being connected to a selective electrode and a ground electrode,

wherein each heat generating resistance member and corresponding selective and ground electrodes integrally form a U-shaped conductive path with each U-shaped conductive path facing in the same direction, and each selective electrode, ground electrode and corresponding heat generating resistance member are laminated in at least two layers; and

cutting the base plate along a line substantially parallel to the line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form the substrate, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate.

19. A process for producing an ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, the process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of electrodes including at least one selective electrode and at least one ground electrode, with each of the plurality of heat generating resistance members being connected to a selective electrode and a ground electrode, wherein each heat generating resistance member and corresponding selective and ground electrodes integrally form a U-shaped conductive path with each U-shaped conductive path facing in the same direction, and each selective electrode, ground electrode and corresponding heat generating resistance member are laminated in at least two layers;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form a substrate for the ink jet recording head, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate; and attaching a liquid passageway forming member onto the substrate, whereby a plurality of liquid passageways are formed corresponding to the U-shaped conductive paths.

20. An ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, the ink jet recording head being produced by a production process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of electrodes including at least one selective electrode and at least one ground electrode, with each of the plurality of heat generating resistance members being connected to a selective electrode and a ground electrode, wherein each heat generating resistance member and corresponding selective and ground electrodes integrally form a U-shaped conductive path with each U-shaped conductive path facing in the same direction, and each selective electrode, ground electrode and corresponding heat generating resistance member are laminated in at least two layers;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form

a substrate for the ink jet recording head having a cut end portion, the location for cutting
determining a relative location between the plurality of heat generating resistance members and
the plurality of discharge openings of the ink jet recording head to be produced using the
substrate; and

attaching a liquid passageway forming member onto the substrate, whereby a
plurality of liquid passageways are formed corresponding to the U-shaped conductive portions,
wherein the end portions of the plurality of liquid passageways are formed
corresponding to the cut end portion of the substrate.

21. An ink jet recording apparatus comprising an ink jet recording head
comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid
passageways each communicating with one of the plurality of discharge openings, and a
controller for supplying electric power to the ink jet recording head, the ink jet recording head
being produced by a production process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating
resistance members arranged generally along a line and a plurality of electrodes including at least
one selective electrode and at least one ground electrode, with each of the plurality of heat
generating resistance members being connected to a selective electrode and a ground electrode,
wherein each heat generating resistance member and corresponding selective and ground
electrodes integrally form a U-shaped conductive path with each U-shaped conductive path
facing in the same direction, and each selective electrode, ground electrode and corresponding
heat generating resistance member are laminated in at least two layers;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form a substrate for the ink jet recording head having a cut end portion, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate; and

attaching a liquid passageway forming member onto the substrate, whereby a plurality of liquid passageways are formed corresponding to the U-shaped conductive paths, wherein the end portions of the plurality of liquid passageways are formed corresponding to the cut end portion of the substrate.

22. A process for producing a substrate for an ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, the process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of pairs of electrodes each connected to one of the plurality of heat generating resistance members, wherein each said pair of electrodes and each corresponding heat generating resistance member integrally form a U-shaped conductive path with a bent portion arranged with all of said bent portions facing in the same direction, wherein each said pair of electrodes and each corresponding heat generating resistance member are laminated in layers; and

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form the substrate, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate.

23. A process for producing an ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, the process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of pairs of electrodes each connected to one of the plurality of heat generating resistance members, wherein each said pair of electrodes and each corresponding heat generating resistance member integrally form a U-shaped conductive path with a bent portion arranged with all of said bent portions facing in the same direction, wherein each said pair of electrodes and each corresponding heat generating resistance member are laminated in layers;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form a substrate for the ink jet recording head, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate; and

attaching a liquid passageway forming member onto the substrate, whereby a plurality of liquid passageways are formed corresponding to the U-shaped conductive paths.

24. An ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, the ink jet recording head being produced by a production process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of pairs of electrodes each connected to one of the plurality of heat generating resistance members, wherein each said pair of electrodes and each corresponding heat generating resistance member integrally form a U-shaped conductive path with a bent portion arranged with all of said bent portions facing in the same direction, wherein each said pair of electrodes and each corresponding heat generating resistance member are laminated in layers;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form a substrate for the ink jet recording head having a cut end portion, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate; and

attaching a liquid passageway forming member onto the substrate, whereby a plurality of liquid passageways are formed corresponding to the U-shaped conductive paths,

wherein the end portions of the plurality of liquid passageways are formed corresponding to the cut end portion of the substrate.

25. An ink jet recording apparatus comprising an ink jet recording head comprising a plurality of discharge openings for discharging a liquid and a plurality of liquid passageways each communicating with one of the plurality of discharge openings, and a controller for supplying electric power to the ink jet recording head, the ink jet recording head being produced by a production process comprising the steps of:

forming in a predetermined pattern on a base plate a plurality of heat generating resistance members arranged generally along a line and a plurality of pairs of electrodes each connected to one of the plurality of heat generating resistance members, wherein each said pair of electrodes and each corresponding heat generating resistance member integrally form a U-shaped conductive path with a bent portion arranged with all of said bent portions facing in the same direction, wherein each said pair of electrodes and each corresponding heat generating resistance member are laminated in layers;

cutting the base plate along a line substantially parallel to said line along which the plurality of heat generating resistance members are arranged at a location remote by a predetermined distance from each of the plurality of heat generating resistance members to form a substrate for the ink jet recording head having a cut end portion, the location for cutting determining a relative location between the plurality of heat generating resistance members and the plurality of discharge openings of the ink jet recording head to be produced using the substrate; and

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